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Trends in Corporation Finance

By Karlyn Mitchell

The economywide turbulence accompanying policies designed to reduce inflation has forced agents in all sectors of the economy to modify their economic strategies. This is particularly true for nonfinancial corporations. Concern was expressed throughout the 1970s that managements of nonfinancial corporations were being lured by the prospect of ever-increasing prices to pursue risky financial policies.¹ The sudden reversal of the inflation outlook combined with the prospect of substantially slower growth in the immediate future has caused some observers to express concern over the solvency of corporate-sector enterprises during the transition period.²

In view of these concerns, this article analyzes recent trends in nonfinancial corporate

finance and examines factors behind the trends. A hypothesis developed here is that while the financial strength of the corporate sector has apparently deteriorated when measured by conventional yardsticks, these yardsticks are not adequate for making historical comparisons of financial soundness. In particular, significant changes in financial markets and financial institutions have altered the norm for prudent corporate financial policies. The first section of the article examines aggregate financial data for the nonfinancial corporate sector and identifies three apparent shifts in financing patterns. The next three sections posit explanations for the trends identified in the first section. Conclusions are stated in the fifth and final section.

PATTERNS OF CORPORATION FINANCE

This section describes some of the major trends of the past two decades in financing by nonfinancial corporations. The first part of the section presents the principal corporate financial statements. The second part presents aggregate financial data for the nonfinancial corporate sector.

Corporate financial statements

Transactions that change the assets and liabilities of an ongoing business enterprise during an accounting period are summarized in its

¹ The financial condition of the corporate sector has served periodically as the subject of articles in popular financial magazines. See, for example, "The Debt Economy," *Business Week*, October 12, 1974, and "The Capital Cloud Over Smokestack America," *Fortune*, February 23, 1982.

² See Henry Kaufman, "Danger: Too Much Turbulence," *Challenge*, May/June 1982, pp. 4-14; "Do You Sincerely Want to End Inflation?" *Forbes*, March 29, 1982; and "Debt's New Dangers," *Business Week*, June 26, 1982.

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Table 1
SOURCES AND USES OF FUNDS*

Sources

Internal

Undistributed Profits (Retained Earnings)
Depreciation

External

Net Equity Issues
Net Debt Issues†

Uses

Net Increases in Financial Assets

Liquid Assets‡
Other Financial Assets§

Capital Expenditures

Plant and Equipment
Inventory Investment
Other Capital Assets

*Adapted from the Board of Governors of the Federal Reserve System, Flow-of-Funds Accounts.

†Debt includes both long-term and short-term debt. Long-term debt includes bonds, mortgages, and long-term bank loans. Short-term debt includes short-term bank loans and other loans, commercial paper, profit taxes payable, and trade debt.

‡Liquid assets include cash, demand and time deposits, U.S. government securities, and other marketable securities.

§Other financial assets include consumer and trade credit.

sources and uses of funds statement (see Table 1). Entries under the "uses" portion of the statement represent outlays made during the accounting period to acquire stocks of financial and nonfinancial assets. Financing for these acquisitions comes from internal sources (profits retained after dividend payments and reserves deductible under U.S. tax law for capital consumption) and external sources (funds raised through the sale of financial instruments). Since all the funds raised from a given source must be applied to one of the uses of corporate funds, the sources of funds sum to the total uses of funds.

While the sources and uses of funds statement summarizes transactions that affect an enterprise's assets and liabilities, the balance sheet presents the value of the assets and liabilities themselves at the close of an accounting period (see Table 2). Under historical cost accounting, the method on which most published corporate financial statements are based, the end-of-period balance sheet is computed by adding the components of the sources and uses of funds to the appropriate accounts in the balance sheet from the close of the previous accounting period. Hence, the debt liability outstanding at the end of an accounting period is the debt liability outstanding at the end of the previous period plus net debt issues from the sources and uses statement. Similarly, shareholders' equity at the end of an accounting period is the previous period's equity plus undistributed profits and net equity issues. Tangible assets—net plant and equipment, inventories, and other capital assets—equal the previous period's tangible assets plus capital expenditures less depreciation and sales. Under histori-

Table 2
BALANCE SHEET*

Assets

Liquid Assets
Other Financial Assets
Inventories
Net Plant and Equipment†
Other Capital Assets

Liabilities and Shareholders' Equity

Debt
Shareholders' Equity (Net Worth)
Paid-in Capital‡
Cumulative Retained Earnings

*Adapted from the Board of Governors of the Federal Reserve System, Balance Sheets for the U.S. Economy.

†Net plant and equipment is the sum of all past expenditures on plant and equipment less all past depreciation deductions and sales.

‡Paid-in capital is the sum of all past net equity issues.

cal cost accounting, the computed values of individual assets and liabilities are referred to as the book values of the accounts.³

Aggregate financial data

Historical financial statement data for the nonfinancial corporate sector are presented in Charts 1 and 2. Chart 1 presents components of the sources of corporate funds as a fraction of total sources. Chart 2 depicts the book values of selected balance sheet accounts divided by the book value of balance sheet assets.

An examination of the historical data reveals distinct trends in corporate indebtedness, in the average maturity of corporate debt, and in corporate liquidity. The first two trends can be seen from the aggregate sources and uses data. Except for the sharp reversals in 1975 and 1980, internal funds dwindled steadily as a source of funds. External funds increased as a proportion of total sources, with debt, rather than new equity, the primary external source of funds. Indeed, net new equity issues never accounted for more than 9 percent of total sources of funds, and in six of the past 22 years corporations repurchased more equity than they issued. In addition to the increase in debt financing, the use of short-term debt increased relative to long-term debt.

Historical cost balance sheet data point up the cumulative effects that trends in the sources of funds had on the composition of corporate balance sheets. From 1960 through the early

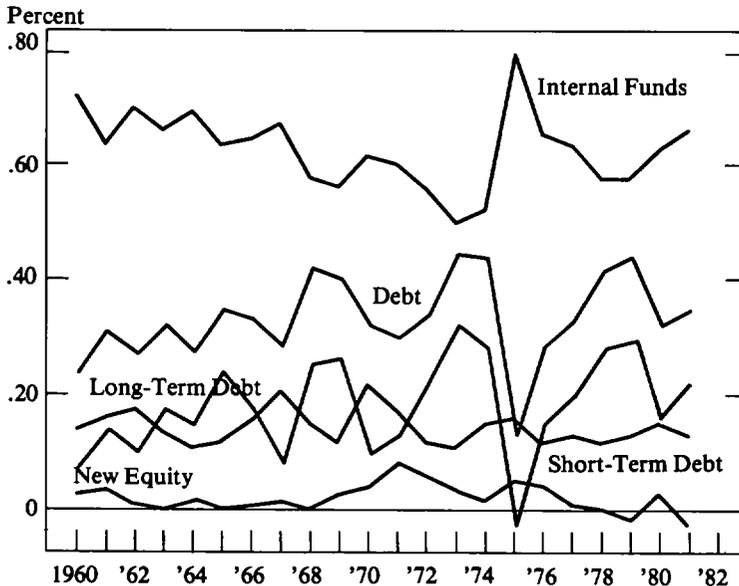
1970s, the effect of dwindling internal funds and low net equity offerings combined to cause a decline in shareholders' equity relative to total assets and a rise in debt relative to total assets. In book value terms, the debt-to-asset ratio rose from roughly 43 percent in 1960 to over 51 percent in 1973. The ratio then declined during the 1973-75 recession but rose again in the late 1970s. The average term to maturity of debt on the books of nonfinancial corporations declined from 1960 to 1981 as the short-term debt-to-asset ratio rose relative to the long-term debt-to-asset ratio. The data also show that corporate holdings of liquid assets—primarily cash, demand and time deposits, and government securities—declined relative to assets in the early 1960s.

By conventional measures, the trends in the composition of nonfinancial corporations' balance sheets in book value terms represent a shift to a riskier financial structure.⁴ Because debt financing increases the fixed expenses corporations must pay, an increase in the debt-to-asset ratio raises the probability that low revenues might result in loan default and bankruptcy. Greater use of short-term debt increases vulnerability to interest rate movements and increases the probability that debt must be rolled over when credit conditions are tight. The si-

³ Critics of historical cost accounting point out that it presents a distorted picture of a corporation's financial position when prices and interest rates change over time. These analysts favor market value accounting, which uses current market prices and replacement costs to value financial and depreciable assets, inventories, and liabilities. Under market value accounting, shareholders' equity, referred to as net worth, equals the market value of assets less the market value of liabilities. Hence, shareholders' claim on the corporation fluctuates with the market values of assets and liabilities.

⁴ The corporate sector's financial structure is somewhat stronger when balance sheet assets and liabilities are valued at current market prices. Like historical cost financial statement data, market value data reveal declines in corporate liquidity and the average maturity of corporate debt. The corporate debt-to-asset ratio is substantially lower and the equity (net worth)-to-asset ratio substantially higher when accounts are valued at market prices, however. The net worth-to-asset ratio declined through the early 1970s but much less than the book value equity-asset ratio. Accelerating inflation and high interest rates in the late 1970s caused a sharp increase in the net worth-to-asset ratio and a steep decline in the debt-to-asset ratio by raising the market value of corporate assets and reducing the market value of long-term debt. As a result, total debt at the close of 1981 represented 33 percent of assets, in contrast to 47 percent based on historical cost data.

Chart 1
SOURCES OF FUNDS AS A FRACTION OF TOTAL SOURCES



SOURCE: Board of Governors

multaneous decline in the ratio of liquid assets to total assets and rise in the ratio of short-term debt to total assets increases the probability that corporations will encounter a liquidity shortage when economic activity is slow.

The financial condition of the nonfinancial corporate sector was weaker at the start of the 1980s than at the start of the 1960s whether measured in book value or market value terms. The position at the start of the 1980s, however, appears to have been the result of trends that persisted, with brief interruption, over the previous two decades. During that time, significant changes in institutions, regulations, and other factors affected corporate financial decisions as well as changes in expectations about the long-run inflation rate. To assess the riskiness of corporate financing strategies more accurately, it is necessary to examine the factors that precipitated these trends.

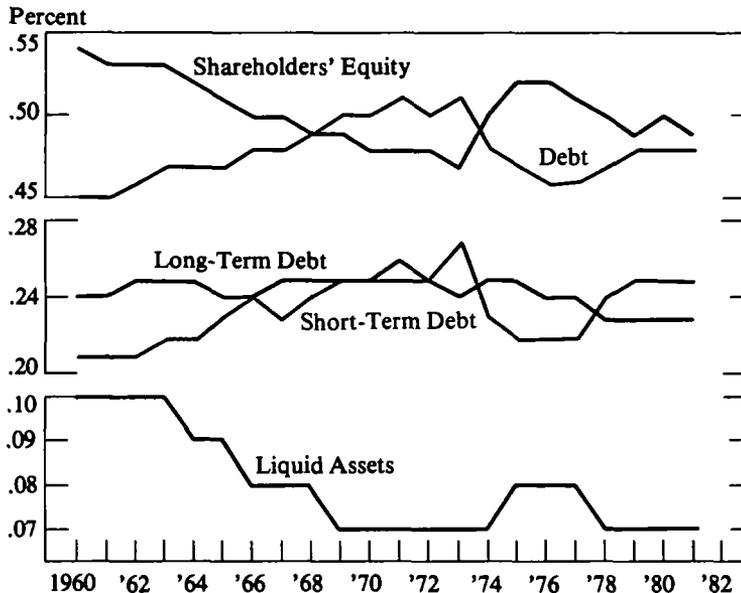
EXPLANATIONS FOR THE INCREASE IN DEBT RELATIVE TO ASSETS

Corporate financial managements increased corporate debt-to-asset ratios between 1960 and 1981. This trend came partly as a response to changes in the availability of internal funds and to factors favoring the issuance of new debt rather than new equity.

Factors affecting internal funds

Because of differential transaction costs, internal funds are a lower cost source of funds than external funds. When internal funds are plentiful, corporate debt-to-asset ratios fall because the acquisition of corporate assets is financed by retained earnings, a component of shareholders' equity. Except in the mid-1970s, and starting again in the late 1970s, the ratio of internal funds to total sources trended downward.

Chart 2
HISTORIC VALUE OF LIQUID ASSETS, LIABILITIES, AND EQUITY
AS A FRACTION OF THE HISTORIC VALUE OF ASSETS



SOURCE: Board of Governors.

The ratio of internal funds to total sources was influenced primarily by two factors. One was the increase in corporate capital expenditures, which strongly influenced the adequacy of internal funds relative to total sources of funds. Corporate planners usually form capital spending plans before deciding how the spending will be financed. Consequently, the availability of funds from particular sources is a comparatively minor consideration in making capital spending decisions.⁵ The decline in internal

sources relative to total sources that occurred from 1960 to 1974 coincided with rapid growth in capital outlays both absolutely and relative to internal sources (see Table 3). The strength of investment spending during that period can be attributed to favorable trends in the principal determinants of investment spending: high levels of output and capacity utilization and low real after-tax capital costs. In 1975, however, brisk growth in capital outlays came to an abrupt halt with a 32 percent decline in outlays from the previous year. With the reduced need for funds, funds raised from external sources declined 64 percent from the year earlier and the ratio of internal funds to total sources reached its highest level since the early 1950s. Sluggish growth in investment spending in the late 1970s and early 1980s lessened corporations' need for external funds and prevented a further rise in debt-to-asset ratios.

⁵ The conventional wisdom that managements make investment and financing decisions sequentially is supported by empirical evidence that investment and dividend decisions are made independently; see Eugene Fama, "The Empirical Relationships Between the Dividend and Investment Decisions of Firms," *American Economic Review*, June 1974, pp. 304-18. For an authoritative review of the determinants of investment decisions, see Dale Jorgenson, "Econometric Studies of Investment Behavior: A Survey," *Journal of Economic Literature*, December 1971, pp. 1111-47.

Table 3
SELECTED CORPORATE FINANCIAL STATISTICS

	<u>1960-64</u>	<u>1965-69</u>	<u>1970-74</u>	<u>1975-81</u>
Capital Expenditures as a Percent of Internal Funds	104.0	121.0	132.0	113.0
Rate of Return on Corporate Assets	4.9	5.6	4.0	4.7
Dividends as a Percent of After-Tax Profits	55.0	51.0	54.0	46.7
Short-Term Debt as a Percent of Long-Term Debt	89.4	97.3	98.6	100.0
Liquid Assets as a Percent of Short-Term Debt	44.5	30.4	30.0	31.5

NOTE: Profits are conventionally reported after-tax profits without inventory valuation and capital consumption adjustment. The rate of return on corporate assets is after-tax profits divided by tangible assets valued at replacement cost.
SOURCE: Board of Governors of the Federal Reserve System.

The other factor that directly affected the availability of internal funds—and hence the debt-to-asset ratio—was the combined effect of changes in corporate profitability and corporate dividend policy. The rate of return on the physical assets of nonfinancial corporations was higher in the mid-1960s than at any other time in the postwar era. In contrast, the return to capital was much nearer the postwar average in the 1970s⁶ (see Table 3). Sharp declines in corporate profitability substantially reduced the flow of internal funds in 1969-70 and again in 1973-74. Corporate profits were so low in those years that the nonfinancial corporate sector would have had to rely on external sources of funds even if all profits had been retained.

Corporate directors influence the availability of internal funds by determining the fraction of

profits paid out as dividends. Even though shareholders' long-term capital gains are taxed at a lower rate than dividends, corporations pay out a substantial proportion of profits as dividends (see Table 3). A well-supported theory of dividend policy asserts that corporate directors prefer to pay a constant fraction of after-tax profits as dividends, with the result that a dollar increase in after-tax earnings per share leads directors to increase dividends per share by \$1 times the payout ratio. In the short run, however, directors' aversion to frequent changes in dividends paid per share causes smaller changes in dividends than changes in profits would justify. Consequently, the amount of dividends paid in the previous quarter is the primary determinant of dividends paid in the current quarter.⁷

The slow response of dividend policies to substantial changes in corporate profitability contributed to the decline in internal funds relative to total sources. Since the rate of return on corporate assets and the dividend payout

⁶ While it is apparent that the average return on corporate assets declined in the late 1960s and was substantially lower in the 1970s than in the previous decade, analysts are not agreed on the causes. Research has focused on two issues: whether the decline in corporate profitability represents a long-run trend or a temporary fluctuation and whether the interactive effects of inflation and the structure of corporate income taxes have reduced the after-tax return on capital. For a summary of the research, see Martha Scanlon, "Postwar Trends in Corporate Rates of Return," in *Public Policy and Capital Formation*, Board of Governors of the Federal Reserve System, 1981, pp. 75-87.

⁷ This theory was first proposed by John Lintner, "Distributions of Incomes of Corporations Among Dividends, Retained Earnings, and Taxes," *American Economic Review*, May 1956, pp. 97-113. Studies published in the 1960s continued to support Lintner's original hypothesis that corporations display inertia in paying dividends.

ratio moved inversely over the past two decades, the decline in corporate profitability in the late 1960s and 1970s was accompanied by an increase in the fraction of profits paid as dividends.⁸ This, in turn, forced nonfinancial corporations to rely more on external sources of funds and contributed to the rising debt-to-asset ratio.

Factors favoring debt finance

Shortfalls in the availability of internal funds over the past two decades made nonfinancial corporations increasingly dependent on external funds. The structure of corporate and personal income taxes and the relative costs of debt and equity caused corporate managements to prefer debt.

The feature of the corporate tax code that most strongly favored debt finance was the deductibility of interest expenses from gross corporate income in computing taxable income. The shielding effect of debt on after-tax income can be illustrated with a simple example. Suppose a corporation has \$100 of earnings before taxes, \$20 in interest expenses, and a marginal tax rate of 50 percent. If interest expenses were not deductible, the corporation would have after-tax income of $\$100 \times 0.5 = \50 and profits after taxes and interest of $\$50 - \$20 = \$30$. Since interest expenses are deductible from gross income, however, the corporation has after-tax income of $0.5(\$100 - \$20) + \$20 = \60 and profits after taxes and interest of $\$60 - \$20 = \$40$, which is \$10 more. Because tax deductible interest expenses increase profits available to shareholders by shielding a portion of income from taxes, managements can increase shareholders' return on equity by relying on debt to finance capital expenditures.

Starting in 1966, rising inflation increased the

⁸ The correlation coefficient between these two variables was -0.59 .

tax advantage of debt finance both by raising nominal interest rates and raising capital income's exposure to taxation. As market participants revise their inflation expectations upward, nominal interest rates also rise. This increases the tax deductible interest expense and the tax shield on corporate income. Hence, inflation increased the advantage to shareholders of corporate debt finance.⁹ Inflation combined with accounting practices which raised potential corporate tax liabilities further encouraged the use of corporate debt. First-in first-out (FIFO) inventory accounting and historical cost-based depreciation deductions overstate before-tax income during an inflation by understating costs.¹⁰ By relying more heavily on debt

⁹ For a theoretical demonstration, see Robert Taggart, "Secular Patterns in Corporation Finance," National Bureau of Economic Research Working Paper No. 810, December 1981. Rising nominal interest rates encourage managements to increase their use of debt subject to the proviso that the probability of costly default is relatively low.

¹⁰ The FIFO method of inventory accounting overstates profits in times of inflation because it uses the prices paid for goods longest held in inventory to calculate the cost of goods produced. Last-in first-out (LIFO) inventory accounting results in a smaller overstatement of before-tax income because it uses the prices paid for goods most recently put into inventory to calculate the cost of goods produced. Despite the tax advantages of LIFO, FIFO continues to be used by roughly three-quarters of manufacturing corporations. The inventory valuation adjustment (IVA) made in the national income accounts corrects for the overstatement of profits caused by FIFO by effectively putting firms on LIFO. When the IVA is made to aggregate corporate profits from 1960 to 1981, adjusted profits are substantially lower.

Historical cost tax depreciation overstates profits during inflations by making the depreciation deduction for the replacement of capital too small. This is because the depreciation deduction is based on the price of the capital goods when they were purchased, rather than the current cost of replacing the goods. The purchasing power of the depreciation deduction is also affected by accelerated depreciation. Under accelerated depreciation, a corporation can deduct more from before-tax profits than the value of capital assets used in production during the early years of an asset's life. The capital consumption adjustment (CCA) in the national income accounts corrects for the distortion

sources of funds, corporate managements reduced taxable income by raising tax-deductible interest expenses.¹¹

Shifts in the ownership of financial wealth within the investor sector also contributed to the increase in corporate debt-asset ratios by changing the impact of the tax structure on investment income. The structure of personal income taxes affects the composition of corporation finance, since it is primarily investors who determine the relative prices (required rates of return) at which corporations offer debt and equity securities. From 1960 to 1981, investors in the household sector held between 74 and 88 percent of nonfinancial corporate equities. Tax regulations on personal investment income should have tended to lower both corporate debt-asset ratios and dividend payout ratios,

to profits caused both by historical cost depreciation and by accelerated depreciation. When the CCA is made to aggregate corporate profits, adjusted profits are slightly higher from 1960 through 1973 and lower from 1974 through 1981.

When the IVA and CCA are both made from 1960 to 1981, adjusted profits of nonfinancial corporations are lower than the profits on which corporations paid taxes. Hence, the net effect of standard accounting practices was to increase the tax liabilities of nonfinancial corporations during this period.

¹¹ Several researchers have attributed the rise in the indebtedness of nonfinancial corporations to the overstatement of taxable income caused by FIFO and historical cost accounting. See, for example, Scanlon. For a formal theoretical treatment of how tax shields affect corporation debt finance, see Harry D. Angelo and Ronald Masulis, "Optimal Capital Structure Under Corporate and Personal Taxation," *Journal of Financial Economics*, March 1980, pp. 3-29.

¹² The nexus between the structure of personal income taxes and corporation finance has been studied in two contexts. Because interest expenses are tax deductible for individuals as well as for corporations, it has been theorized that investors sort themselves into "financial leverage clientele." Specifically, individuals taxed at a marginal rate higher than the corporate tax rate, $t_p^n > t$, will borrow to purchase stock in corporations with low debt-asset ratios because their tax shield, $t_p^n B$, is larger than the corporate tax shield, tB , where B is the tax deductible interest expense. Conversely, individuals taxed at a marginal rate

since interest and dividends paid to individuals are taxed at the ordinary rate while capital gains are taxed when realized at about half the ordinary rate. Moreover, the rise in the effective tax rate on personal income between 1960 and 1981 should have caused managements to reduce debt-asset ratios rather than increase them.

There are two explanations for the failure of personal income taxes to influence corporation finance more strongly. First, empirical evidence suggests that taxes are not a major consideration for most individuals that invest in corporate securities.¹² Second, the growth of financial intermediaries contributed to the greater use of debt by corporations, by changing the legal restrictions on and the tax characteristics of the population of investors.¹³ The larger the pro-

lower than corporations, $t_p^l < t$, will hold stock in corporations with high debt-asset ratios because $t_p^l B < tB$. The only empirical evidence on the leverage clientele theory has been presented by E. H. Kim, W. Lewellen, and J. McConnell, "Financial Leverage Clientele: Theory and Evidence," *Journal of Financial Economics*, March 1979, pp. 89-109. The hypothesis that investors sort themselves into leverage clienteles was overwhelmingly rejected by the data.

It has also been theorized that transaction costs, uncertainty, and differences in the taxation of capital gains and dividends cause investors to sort themselves into "dividend clientele." Since long-term capital gains are taxed at approximately half the rate as dividends, investors taxed at a low marginal rate will hold high dividend-yielding stocks, while investors taxed at a high marginal rate will hold low dividend-yielding stocks. The evidence on the existence of dividend clientele is mixed. Studies that reject this hypothesis include Fischer Black and Myron Scholes, "The Effects of Dividend Yield and Dividend Policy on Common Stock Returns and Prices," *Journal of Financial Economics*, May 1974, pp. 1-22; and R. Gordon and D. Bradford, "Taxation and the Stock Market Valuation of Capital Gains and Dividends," *Journal of Public Economics*, October 1980, pp. 109-36. The opposite conclusion is reached by R. Pettit in "Taxes, Transaction Costs, and the Clientele Effect of Dividends," *Journal of Financial Economics*, December 1977, pp. 419-36.

¹³ Commercial banks, which consistently showed strong growth in the aggregate, are prohibited from holding stock in nonfinancial corporations but are allowed to hold bonds and other corporate loans. Private pension funds, state and

portion of corporate securities held by financial intermediaries, the smaller the impact of the structure of personal taxes on corporate financing decisions.

Managements of nonfinancial corporations also preferred debt to new equity finance because of the persistently higher cost of equity capital. Managers take relative capital costs into account in order to maximize the return on equity of current shareholders by limiting the distribution of corporate income to new security holders. Empirical studies show that relative capital costs are important in corporations' decisions to offer debt or new equity.¹⁴

Table 4 presents data on the costs of debt and equity capital from 1960 to 1981. The real cost of debt capital to a corporation is one minus the tax rate multiplied by the current yield on long-term bonds, minus the inflation rate. The cost of equity capital equals annual after-tax profits divided by the current market value of the corporation's outstanding shares. The third column of the table shows the difference between the costs of the two sources of funds. Cost differentials were particularly favorable to debt finance in the second half of the 1960s and again in the second half of the 1970s. The discrepancy was particularly striking during the latter period. In contrast to the 1960s, when the high relative cost of equity was due to high profit rates, the high relative cost of equity in the 1970s was due to the extremely low value of

local government retirement funds (two of the fastest growing types of intermediaries), and life insurance companies can hold both debt and equity; the income from these investments is exempt from corporate income taxes. Instead, the beneficiaries are taxed on the income received from these institutions.

¹⁴ See Allen Taub, "Determinants of the Firm's Capital Structure," *Review of Economics and Statistics*, November 1979, pp. 410-16; and A. Nakamura and M. Nakamura, "On the Firm's Production, Capital Structure, and Demand for Debt," *Review of Economics and Statistics*, August 1982, pp. 384-93.

Table 4
COST OF CAPITAL FOR
NONFINANCIAL CORPORATIONS

<u>Year</u>	<u>Cost of Equity*</u>	<u>Cost of Debt†</u>	<u>Discrepancy</u>
1960-64	5.6	0.7	4.9
1965-69	6.2	-0.8	7.0
1970-74	4.2	-1.8	6.0
1975-81	6.4	-2.5	8.9

*Cost of equity equals profits of nonfinancial corporations including the cost inventory valuation and capital consumption adjustments (IVA and CCA) divided by the market value of equity.

†Cost of debt equals Moody's Aaa corporate bond yield multiplied by one minus the corporate tax rate less the percentage change in the implicit GNP deflator.

SOURCE: Board of Governors of the Federal Reserve System.

corporate equities. Although there is not agreement on the cause of low stock prices, factors frequently mentioned include extreme pessimism over future corporate profits, expectations of high rates of inflation, and increases in housing prices.¹⁵

The combined impact on the debt-to-asset ratio of factors affecting the flow of internal funds and favoring debt over equity finance can be summarized as follows. The declining ratio of internal funds to total sources was due to relatively high dividend payout ratios in the early 1960s and to the brisk growth of capital expenditures in the mid and late-1960s. In the early 1970s, high capital expenditures, low profitability, and high payout ratios all contributed to the decline in the internal funds relative to total sources. While these developments forced corporations to rely more on external sources of

¹⁵ The failure of stock prices to rise along with the value of corporations' physical assets has been the subject of a vast amount of recent economic research. For a discussion of the issues, see Douglas K. Pearce, "The Impact of Inflation on Stock Prices," *Economic Review*, Federal Reserve Bank of Kansas City, March 1982, pp. 3-18.

funds, the structure of corporate and personal income taxes and the higher relative cost of equity capital caused corporate managements to prefer debt financing. Consequently, the debt-to-asset ratio of the nonfinancial corporate sector rose from 1960 through the mid-1970s. In the late 1970s and early 1980s, slower growth in capital expenditures, greater profitability, and lower payout ratios increased the availability of internal funds and reversed the rise in the debt-to-asset ratio.

EXPLANATIONS FOR THE DECLINING MATURITY OF CORPORATE DEBT

Throughout most of the last two decades, the average term to maturity of corporate debt declined as the ratio of short-term debt to long-term debt increased. Explanations for this trend include changes in the durability of corporate assets and a shift in investor preferences toward short-term securities.

Changing durability of corporate assets

According to conventional wisdom, corporate managements try to maintain parity between the average term to maturity of corporate liabilities and the term to maturity (the durability) of corporate assets. By matching maturities, managements hope to reduce capital costs by reducing the effect of interest rate fluctuations on net worth. The ratio of net worth to debt is often used as a measure of corporate financial soundness. This is because the larger and more stable the net worth-to-debt ratio over time, the lower the profitability of insolvency and bankruptcy.¹⁶ By reducing fluctuations in net worth,

¹⁶ The net worth-to-debt ratio has been described as the most fundamental long-range measure of a corporation's financial strength. See Edgar Fiedler, *Measures of Credit Risk and Experience*, National Bureau of Economic Research, 1971, Chapter 5. In an article summarizing 26 empirical studies using financial ratios to forecast financial conditions and performance of nonfinancial corporations,

a maturity-matching strategy tends to reduce a corporation's cost of capital by reducing the risk premium that investors in a corporation's debt and equity securities require.¹⁷

Since recent empirical studies support the hypothesis that corporate managements approximately match asset and liability maturities,¹⁸ the decline in the average term to maturity of corporate debt should have been due partly to a

the net worth-to-debt ratio was the financial ratio most frequently found to have a predictive power. See Kung Chen and Thomas Shimerda, "An Empirical Analysis of Useful Financial Ratios," *Financial Management*, Spring 1981, pp. 51-60.

¹⁷ How maturity matching reduces variations in net worth can be illustrated by two examples. In the first example, suppose a corporation holds a short-term asset expected to pay \$100 in one year and a \$100 debt also due in one year. If the current interest rate is 10 percent, the current market value of both the asset and liability is $\$100/(1 + .10) = \90.90 . Net worth is zero. An increase (decrease) in the interest rate to 11 percent (9 percent) causes the value of both the asset and the liability to fall (rise) to \$90.10 (\$91.74). The interest rate change leaves net worth unchanged at zero because the asset and liability represent offsetting cash flows at the same point in time. In the second example, the corporation has the same asset as in the first example and a debt of \$235.77 due in 10 years. If the current interest rate is 10 percent, net worth is zero since the current value of the debt is $\$235.77/(1 + .10)^{10} = \90.90 . However, an interest rate increase (decrease) to 11 percent (9 percent) causes net worth to go from zero to \$7.07 (-\$7.86) by decreasing (increasing) the current value of the liability to \$83.03 (\$99.60). Because the asset and liability represent unsynchronized cash flows, the interest rate change affects the current values of the asset and liability differently and, hence, affects net worth. In the second example, if the interest rate declines and the corporation is forced to liquidate, the creditor would have a capital loss.

¹⁸ William White, "Debt Management and Form of Business Financing," *Journal of Finance*, May 1974, pp. 565-77; and Robert Taggart, "A Model of Corporate Financing Decisions," *Journal of Finance*, December 1977, pp. 1467-84. White found that a one dollar increase in plant and equipment investment, investment in liquid assets, and inventory investment caused net long-term bond offerings to increase by \$0.41, \$0.31, and \$0.25, respectively. Taggart found support for the hypothesis that managements use long-term debt to finance fixed investment and the permanent component of inventories, and use short-term debt to finance transitory inventories and liquid asset accumulation.

Table 5
PRINCIPAL HOLDERS OF CORPORATE SECURITIES, 1960-80
(In billions of dollars)

	<u>1960</u>	<u>Percent of Total Outstanding</u>	<u>1980</u>	<u>Percent of Total Outstanding</u>
Commercial Banks				
Total Financial Assets	224.2		1,244.7	
Loans to Nonfinancial Corporations	37.6	100.0	296.5	100.0
Households				
Total Financial Assets	973.4		2,241.3	
Corporate Bonds	10.0	11.1	86.9	17.2
Corporate Equities	395.5	87.7	1,215.6	74.3
Selected Nonbank Financial Intermediaries*				
Total Financial Assets	173.6		954.7	
Corporate Bonds	70.9	78.6	331.6	66.0
Corporate Equities	22.1	4.8	273.0	16.6

*Includes life insurance companies, private pension funds, and state local government retirement funds.
SOURCE: Board of Governors of the Federal Reserve System.

decline in the durability of corporate assets. Assets that are liquidated in a year or less, such as financial securities and inventories, comprised a stable proportion of total assets from 1960 to 1981. The durability of fixed capital declined steadily, however, as an increasing share of corporate capital budgets went to relatively short-lived equipment and a decreasing share went to long-lived structures. The shift caused the maturity of corporate assets to decline.¹⁹ Since managements practiced maturity-matching strategies, the declining maturity of corporate debt reflected, in part, the declining maturity of corporate assets.²⁰

¹⁹ Expressed in billions of 1972 dollars, the nonfinancial corporate sector's investment in nonresidential structures as a percentage of equipment was: 1960-64, 77.0; 1965-69, 66.3; 1970-74, 56.3; 1975-81, 42.1.

²⁰ The change in the composition of business-fixed investment has been attributed to the bias of the tax structure favoring equipment and to relative prices. For a recent discussion of these issues, see Robert Tannenwald,

Investor preferences

Substantial shifts in the composition and size of the financial portfolios of the investor sector probably contributed to the trend toward shorter term credit market debts for nonfinancial corporations. Some of these developments are highlighted in Table 5, which shows the financial asset holdings of principal investors in corporate securities in 1960 and 1980. Both life insurance companies and private pension funds reduced their holdings of long-term corporate bonds relative to their total financial assets. Even though state and local government retirement funds increased their bond holdings relative to assets, the proportion of bonds held by these three investor categories fell. Commercial banks, whose term loans have original maturities of 10 years or less, increased the propor-

"Federal Tax Policy and the Declining Share of Structures in Business Fixed Investment," *New England Economic Review*, July-August 1982, pp. 27-39.

tion of loans to nonfinancial corporations in their asset portfolios. Households also increased their holdings of corporate bonds relative to financial assets.

The growing volatility of interest rates combined with the tendency for more corporate debt to be held by households and institutional investors with fairly short-term liabilities probably contributed to the declining maturity of corporate debt by reducing the supply of long-term credit. Like corporations, investors can reduce fluctuations in their net worth by matching the maturities of their assets and liabilities. Hence, as investors with a strong preference for credit instruments of shorter maturity became a more important source of credit, nonfinancial corporations were probably forced to tailor their debt offerings to the market.²¹

EXPLANATIONS FOR THE DECLINE IN LIQUID ASSETS RELATIVE TO TOTAL ASSETS

Liquid assets held by nonfinancial corporations fell sharply in the first half of the 1960s relative to both total assets and short-term debt.²² Contributing to the decline were significant developments in financial markets that enhanced the ability of corporations to raise funds quickly. Two of the more important developments were the growth of the commercial paper market and the greater use of bank loan commitments.

The commercial paper market

At the start of the 1960s, commercial paper was a source of funds little used by nonfinan-

cial corporations.²³ The situation began to change in 1966 when interest rates exceeded the Regulation Q ceilings, causing funds to flow out of banks and thrifts.²⁴ Many of the largest nonfinancial corporations responded to the shortage of bank credit by placing their short-term obligations with investors in the household, financial, and business sectors through commercial paper dealers. The commercial paper market has grown rapidly since then as the number of corporations issuing paper increased and as managements substituted more open-market credit for bank credit. The development of this market probably helped reduce corporate holdings of liquid assets in two ways. First, corporations issuing commercial paper are not required to maintain compensating balances in proportion to the liability, as they are under most bank loan agreements. Second, since commercial paper can be issued with little delay to a national market, corporations with access to the market are free of the need to hold low-yielding liquid assets against the possibility of having their credit rationed by their banks.

Bank loan commitments

The credit shortages of the mid and late-1960s also caused the use of bank loan commitments to become widespread. A loan commitment is essentially a promise by a bank to make credit available to a client at the client's discretion any time during the term of the commitment. The term over which credit extension is guaranteed depends on the type of agreement. Under an open line of credit, a client can borrow during a period—usually a year—any amount up to a prearranged max-

²¹ A similar argument is suggested by Robert Taggart (1981).

²² The decline in corporate liquidity is more dramatic when measured by the ratio of liquid assets to marketable short-term debt. The historical averages for this ratio are: 1960-64, 1.6; 1965-70, 1.0; 1971-74, 0.8; 1975-81, 0.7.

²³ Commercial paper is unsecured promissory notes maturing in one year or less.

²⁴ The Federal Reserve System's Regulation Q specifies maximum interest rates that member banks can pay on deposits. Similar interest rate restrictions apply to nonmember banks and other depository institutions.

imum. A revolving credit allows the client to borrow varying amounts during a term that normally lasts from two to three years. Banks also commit themselves to make term loans with maturities of up to 10 years. In return for the guarantee of credit, the corporation pays a commitment fee in addition to the interest on loans actually taken down. More than half of the currently outstanding commercial and industrial loans were made under commitments. By guaranteeing the availability of funds, the effect of loan commitments has probably been to reduce corporate holdings of liquid assets.

SUMMARY AND CONCLUSIONS

By conventional yardsticks, financial data for the aggregate nonfinancial corporate sector reveal a progressive weakening in the strength of corporate balance sheets. Over the past two decades, debt liabilities have increased relative to total assets, while the ratio of shareholders' equity to total assets, the average maturity of corporate debt, and corporate liquidity have declined. These changes have increased the apparent riskiness of corporate balance sheets by raising fixed payment obligations, increasing the frequency of debt refinancings, and reducing the ability of corporate enterprises to withstand shortfalls in revenues.

This article has analyzed whether corporate-sector financial soundness has, in fact, deteriorated when changes in financial market institutions are taken into account. The evidence suggests that the erosion in corporate solvency is much less severe than conventional criteria imply. Such developments as the expansion of the commercial paper market and the greater use of bank loan commitments may have led to a reduction in liquid assets relative to total assets without a decline in corporate liquidity. Also, to the extent that the declining maturity of cor-

porate debt was matched by a decline in the maturity of corporate assets, the riskiness of corporate financial positions has not been affected.

Clearly, the riskiness of corporate financial positions was increased by the secular rise in the corporate debt-to-asset ratio. The risk was not assumed without the anticipation of eventual reward, however. The corporate debt-asset ratio rose partly because corporations had more profitable investment opportunities than could be financed internally. This ratio also rose because of the persistence of substantial cost and tax advantages to debt finance. Viewed in this light, the apparent deterioration in corporate financial soundness was actually the result of prudent management.

Despite the factors favoring the use of borrowed funds, the corporate debt-asset ratio rarely exceeded 50 percent in book value terms or 40 percent in market value terms. The most likely explanation for this seeming paradox is that corporate managements select debt-asset ratios by trading off the potential risks to shareholders against the potential returns from assuming additional risks.²⁵

Following this reasoning, it can be argued that the decline in the corporate-sector debt-asset ratio starting in 1974 was the response of risk-averse managements to greater uncertainty caused by unanticipated price shocks and growing volatility in interest rates and inflation. Until the volatility associated with the transition to a lower inflation rate subsides, managements of nonfinancial corporations can be expected to continue lowering their debt-asset ratios as a risk-reducing measure.

²⁵ Other factors that may limit corporate use of debt include legal restrictions imposed by creditors and the distribution of investors among tax brackets.

The Effect of Alternative Discount Rate Mechanisms on Monetary Control

By Howard L. Roth and Diane Seibert

When the Federal Reserve changed its operating procedure in October 1979 from an interest rate to a reserve aggregate operating variable, discount window borrowing—depository institution borrowing from the Federal Reserve District Banks—became an important factor in the Federal Reserve's efforts to control monetary growth. Under the new regime, administration of the discount window also has had important implications for short-term market interest rates. Partially in recognition of the importance of discount window borrowing on its monetary control efforts, the Federal Reserve on occasion has imposed a discount rate surcharge on large and frequent borrowers. In addition, other proposals have been advanced for administering the discount window.

In view of the increased importance of discount window policy, this article analyzes the effects of alternative discount window policies on monetary control. The first section of the article describes the reserves and money markets and their interrelationship. The second section analyzes alternative discount window policies and illustrates their effects on the money supply function. The third section points out how un-

expected changes in money supply or money demand complicate monetary control and examines the implications of alternative discount window policies for monetary control and interest rate volatility. Empirical evidence on the effects of alternative discount window mechanisms is presented in the last section.

The analysis presented in the article suggests that discount window mechanisms can dampen the effects of disturbances on monetary growth and interest rates without involving direct action on the part of the monetary authority. However, the degree of such automatic control of a monetary disturbance depends on the kind of discount window policy employed and the source of the disturbance. As a result, no single policy provides maximum control for all situations. Furthermore, the adoption of a frequently advocated policy, a penalty discount rate policy, could dramatically increase short-term interest rate volatility.

THE RESERVES AND MONEY MARKETS

The ability of the Federal Reserve to influence key economic variables derives from its influence on the availability of reserves to depository institutions. Reserve availability, in turn, affects interest rates as well as the growth of money and credit. The authority of the Federal Reserve to require depository institutions

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to hold a fraction of their deposits as reserves provides the link between reserves and monetary aggregates. Thus, analysis of the effects of discount window policy on monetary control must begin with an analysis of the demand for and supply of reserves.

The reserves market

The demand for reserves is the sum of financial institutions' demands for required reserves and excess reserves, the latter being reserves that depository institutions hold in addition to their required reserves. To simplify the analysis in this section, it is assumed that reserve accounting is contemporaneous, that a uniform reserve requirement is imposed on transactions accounts, and that no reserves are required for other deposits.¹ Accordingly, the demand for required reserves is assumed to be a fraction of total transactions deposits.² Since transactions

deposits generally earn less than a market rate of return, the demand for transactions deposits and thus the demand for required reserves are inversely related to market interest rates.

The demand for excess reserves constitutes the second component of the demand for total reserves.³ Because depository institutions earn no income on reserve balances, they would be expected to reduce their holdings of excess reserves as short-term market rates rose. However, this interest elasticity of the demand for excess reserves has been difficult to identify empirically. As a result, the demand for excess reserves is assumed in this article to be interest insensitive.⁴

The demand for total reserves—the sum of the demands for required reserves (RR) and excess reserves (ER)—is graphically represented in Figure 1 by TR^d . The quantity demanded is inversely related to the federal funds rate, rF , reflecting the assumed negative relationship between market interest rates and the demand for transactions account balances from which the demand for required reserves derives.⁵

The supply of reserves to depository institutions also consists of two components, reserves borrowed from the Federal Reserve at the discount window, BR , and nonborrowed reserves

¹ Over the past few decades, the Federal Reserve has used two accounting methods in determining required reserves. Prior to September 12, 1968, a contemporaneous reserve accounting system was used, in which a financial institution's current required reserves are based on its current deposit liabilities. Since then, a lagged reserve accounting system has been used. Under this system, an institution's required reserves are computed as a fraction of deposits held two weeks before. In an effort to improve control over monetary aggregates, the Federal Reserve will return to contemporaneous reserve accounting in February 1984. In a separate development, the Depository Institutions Deregulation and Monetary Control Act of 1980 (DIDMCA) has broadened the range of institutions subject to Federal Reserve System reserve requirements and instituted a transition to primarily exclusive reservability of transactions accounts. With a few exceptions, only member banks of the Federal Reserve System were subject to Federal Reserve requirements prior to DIDMCA. Now, all depository institutions are required to maintain reserves.

² Under these assumptions, depository institutions have the following demand for required reserves,

$$(1) RR^d = \Upsilon \cdot D,$$

where D is the demand for transactions account balances, RR^d is the demand for required reserves, and Υ is the required reserve ratio.

³ For various reasons, financial institutions may hold more reserves than required. Uncertainty about levels of reservable deposits and, hence, required reserves may induce institutions to hold excess reserves to reduce the likelihood of having to make undesired adjustments at the end of an accounting period. Institutions also may increase their holdings of excess reserves when the money markets are unstable. Furthermore, institutions may adjust their levels of excess reserves in anticipation of interest rate movements.

⁴ Algebraically, the demand for excess reserves, ER^d , is given by

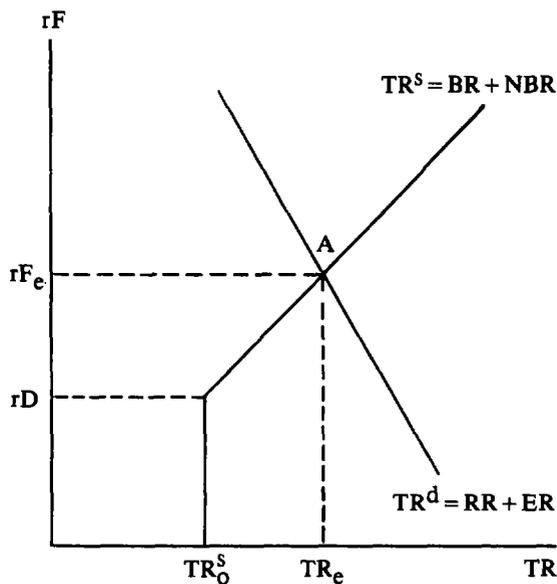
$$(2) ER^d = \overline{ER}.$$

⁵ The interest sensitivity of the demand for transactions account balances is discussed in the description of the money market below.

obtained from other sources, NBR. The Federal Reserve influences nonborrowed reserves through open market operations.⁶ A purchase of securities in the open market increases nonborrowed reserves, and an open market sale of securities reduces nonborrowed reserves. When the Federal Reserve uses nonborrowed reserves as an operating target, as it has since October 1979, the supply of nonborrowed reserves can be represented as an interest-insensitive level determined by the Federal Reserve.⁷

Depository institutions also can obtain reserves by borrowing from their District Federal Reserve Bank at the discount rate. For the most part, discount window borrowing is intended to help depository institutions make short-run adjustments in meeting their reserve requirements. Instead of borrowing from the Federal Reserve to meet its reserve requirements, a financial institution can borrow reserves from other financial institutions in the federal funds market or take other actions that redistribute reserves among financial institutions without altering the aggregate level of reserves. The federal funds market is such an important alternative to borrowing from the Federal Reserve that the demand for borrowed reserves is determined primarily by the spread (difference) between the federal funds rate and the discount

Figure 1



rate. When the federal funds rate is at or below the discount rate, i.e., for nonpositive spreads, borrowing tends to be at a minimal level which is interest insensitive. But when the spread is positive, borrowing from the Federal Reserve becomes more attractive and increasingly so as the spread increases. The sensitivity of borrowing to positive spreads reflects Federal Reserve guidelines governing access to the discount window, the reluctance of institutions to use their limited borrowing privilege, and a traditional unwillingness of some banks to borrow from the Federal Reserve at all.⁸

⁶ When the Federal Reserve buys securities, it credits the account of the security dealer's depository institution, injecting reserves into the financial system. A sale of securities by the Federal Reserve removes reserves from the system. Nonborrowed reserves are also affected by technical market factors such as unexpected flows into or out of Treasury deposits at Federal Reserve Banks and changes in float.

⁷ An approximation of the supply of nonborrowed reserves is given by

$$(3) \text{NBR} = \text{NBR}^*$$

where NBR* is the level set by the Federal Reserve. This formulation ignores technical factors that might affect the level of nonborrowed reserves (footnote 6).

⁸ A simple model of discount window borrowing is

$$(4) \text{BR} = \begin{cases} \overline{\text{BR}}, & \text{for } rF \leq rD \\ \overline{\text{BR}} + b \cdot (rF - rD), & \text{for } rF > rD \end{cases}$$

where BR is the interest-insensitive level of borrowing, rF is the federal funds rate, rD is the discount rate, and b is the slope of the borrowing function for positive spreads (note, $b > 0$).

Adding the supply of nonborrowed reserves, NBR, to the supply of borrowed reserves, BR, yields the supply of total reserves, TR^S, shown graphically in Figure 1. The federal funds rate and the discount rate are denoted rF and rD, respectively. For nonpositive spreads (i.e., for values of rF which are less than or equal to rD), the supply of total reserves consists of nonborrowed reserves and interest-insensitive borrowings. Since nonborrowed reserves also are interest insensitive, the supply of total reserves is interest insensitive for nonpositive spreads, as indicated by the vertical segment of the TR^S curve in Figure 1. In addition to these components, the sum of which is indicated by TR₀^S in Figure 1, interest-induced borrowing contributes to the supply of total reserves when the spread is positive (i.e., when the funds rate is above the discount rate). The tendency of this borrowing to increase with the spread is reflected in the upward-sloping segment of TR^S.⁹

⁹ The graph of TR^S is simply the graph of BR shifted rightward by NBR*.

¹⁰ The reserve market equilibrium condition is obtained by equating the sum of equations 1 and 2 with the sum of equations 3 and 4

$$\overline{BR} + b \cdot (rF - rD) + NBR^* = \gamma \cdot D + \overline{ER}, \text{ for } rF > rD$$

$$\overline{BR} + NBR^* = \gamma \cdot D + \overline{ER}, \text{ for } rF \leq rD.$$

The expression for positive spreads can be solved for the equilibrium funds rate

$$rF_e = rD + \frac{\gamma}{b} \cdot D + \frac{1}{b} \cdot (\overline{ER} - \overline{BR} - NBR^*), \text{ for } rF > rD.$$

The value of the equilibrium federal funds rate depends on the contemporaneous level of transactions account balances. Alternatively, for both positive and nonpositive spreads, the reserve market equilibrium condition can be solved for D.

$$(5) D = \begin{cases} \frac{1}{\gamma} \cdot (\overline{BR} + NBR^* - \overline{ER}) + \frac{b}{\gamma} \cdot (rF - rD), & \text{for } rF > rD \\ \frac{1}{\gamma} \cdot (\overline{BR} + NBR^* - \overline{ER}), & \text{for } rF \leq rD. \end{cases}$$

The reserve market is in equilibrium when the demand for total reserves equals the supply of total reserves. This equilibrium, point A in Figure 1, determines the level of the federal funds rate, rF_e, and the level of total reserves, TR_e.¹⁰

The money market

The demand for money derives from its role as a medium of exchange.¹¹ As transactions deposits typically earn a lower rate of return than other assets, the nonbank public tends to reduce its transactions balances as rates of return on other assets rise and to increase its holdings of assets with higher yields. This behavior can be represented simply by specifying that the demand for money is inversely related to a market rate of interest, such as the federal funds rate.¹² The demand for transactions balances also is positively related to income because increases in income cause an increase in transactions that must be financed by the means of payment. The

¹¹ Transactions balances are held primarily as currency and transactions account balances. To simplify the analysis in this section, a currency-less economy is assumed. With this assumption, transactions balances, hereafter called money, are held entirely in transactions accounts at depository institutions. In the empirical analysis in the last section of this article, currency is not assumed away.

¹² Because the nonbank public participates little in the federal funds market, use of the funds rate as a measure of the opportunity cost of holding transactions balances may not seem appropriate. Its use simplifies the analysis, however, and can be justified theoretically.

The demand for transactions balances could depend on the rates of return of a number of assets to which transactions balances could be transferred. Empirical evidence suggests, however, that the demand for transactions balances is affected significantly only by the returns on liquid financial assets. Since short-term rates of return characteristically move together, their effect on the demand for transactions balances can be summarized quite well by including a single short-term rate in the demand function. In practice, the federal funds rate performs well in this role and its use simplifies the analysis in this article. Had another rate been used—for example, a 90-day commercial paper rate—the relationship between that rate and the federal funds rate would have had to be specified before the effects of alternative discount window policies could have been analyzed.

demand for money, M^d , for a fixed level of income is depicted in Figure 2.

The reserve market equilibrium condition (demand for total reserves equal to supply of total reserves) can be used to obtain a money supply function. The following equation gives the reserve market equilibrium condition.

$$RR + ER = NBR + BR.$$

If the average reserve requirement is given by γ , the ratio of the money stock to required reserves is $1/\gamma$, which can be thought of as the money-required reserves multiplier.¹³ Substituting $\gamma \cdot M$ for required reserves in the reserve market equilibrium condition and solving for M yields the following money supply relationship,¹⁴

$$M^s = \frac{1}{\gamma} \cdot (NBR + BR - ER).$$

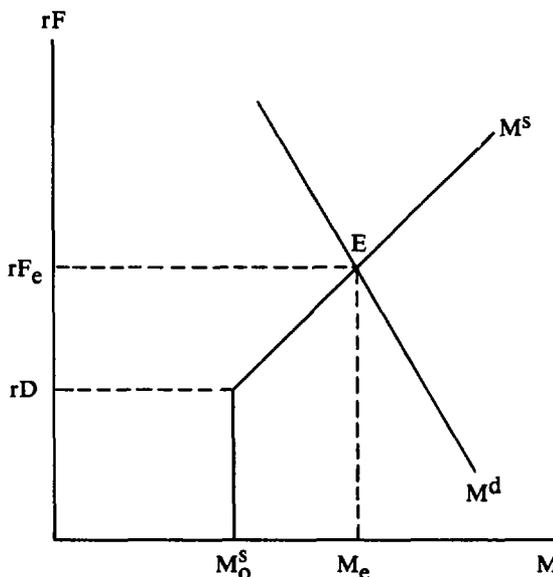
The money supply function shows that the amount of money supplied to the public by depository institutions depends positively on the incentive for these institutions to borrow from the Federal Reserve and on the availability of nonborrowed reserves, and negatively on the demand for excess reserves by these institutions.

Because of the linkage between the money supply and discount window borrowing, the supply of money depends positively on the federal funds rate for positive spreads. An increase in the federal funds rate encourages financial institutions to undertake more discount window borrowing, thereby increasing the amount of reserves available to support expansion of the money supply.

¹³ As a currency-less economy is assumed, transactions deposits and money are equivalent.

¹⁴ For the algebraic model, this relationship is given by equation (5) in footnote 10. To reflect the no-currency assumption, "D" should be replaced by "M" in this equation.

Figure 2



If the demand for excess reserves is insensitive to short-term interest rates, the relationship between M^s and the federal funds rate merely reflects the relationship of discount window borrowing to the federal funds rate.¹⁵ Consequently, a change in discount window policy that affects the interest sensitivity of the supply of borrowed reserves correspondingly changes the slope of the money supply curve.¹⁶ The slope of the money supply function is

¹⁵ Recall that the supply of nonborrowed reserves is interest insensitive.

¹⁶ For example, if the Federal Reserve wanted to discourage borrowing, it could reduce the frequency with which depository institutions are allowed to borrow. Institutions, trying to avoid the possibility of being refused when their needs were more urgent, would then become more reluctant to borrow from the Federal Reserve. At any value of the spread, borrowing would be less than without the change in administration of the discount window. That is, BR would be steeper. As a result, the supply of money would be less responsive to a change in the federal funds rate.

proportional to that of the supply of borrowed reserves.¹⁷ In addition, the money supply function has an interest-insensitive level corresponding to the interest-insensitive level of the supply of total reserves.¹⁸ Consequently, M^S shifts to the right with either an increase in the supply of nonborrowed reserves or interest-insensitive borrowings, or with a decrease in the demand for excess reserves.¹⁹

Equilibrium in the money market, point E in Figure 2, determines the federal funds rate, rF_e , and the money stock, M_e . The federal funds rate is identical to that obtained in equilibrium of the reserves market.

ALTERNATIVE DISCOUNT WINDOW POLICIES AND THE MONEY SUPPLY FUNCTION

This section describes alternative discount window policies and explores their implications for the money supply function. As reasoned in the preceding section, changes in discount window policy that affect the supply of borrowed reserves are reflected in the money supply function. The succeeding section shows that the slope of the money supply function is an important factor in the control of the money stock. Consequently, the current section establishes the critical link between discount window policy and monetary control.

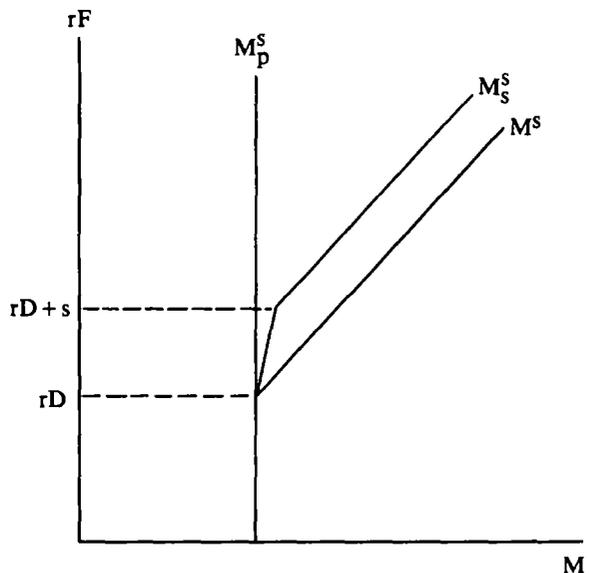
Two alternative discount window policies, a penalty rate policy and a surcharge policy, are examined here. Current discount window policy, described in the preceding section, serves as a reference.

¹⁷ The constant of proportionality is $1/\Upsilon$, which reflects the ability of a given amount of reserves to support a larger amount of deposits ($0 < \Upsilon < 1$).

¹⁸ This level is equal to $\frac{1}{\Upsilon} \cdot (NBR^* + BR - ER)$.

¹⁹ The horizontal shift is equal to $1/\Upsilon$ times the change in nonborrowed reserves, interest-insensitive borrowings, or excess reserves.

Figure 3



A penalty rate

Under the reserve-targeting approach to monetary control adopted by the Federal Reserve in October 1979, there has been considerable short-run variability in the growth of both money and reserves. This variability has led some observers to conclude that for the Federal Reserve to achieve its monetary objectives it needs to obtain closer short-run control over reserves. Convinced that interest rate-induced changes in discount borrowing are the main source of reserve variability, they argue that the Federal Reserve's control over total reserves and money could be improved if discount window borrowing were insensitive to changes in the spread between the federal funds rate and the discount rate.

Because borrowing is highly interest insensitive for negative spreads, keeping the discount rate above the federal funds rate would greatly reduce the interest sensitivity of borrowing. Un-

der such a policy, a financial institution could always obtain reserves in the federal funds market at less cost than borrowing from the Federal Reserve. Consequently, a discount rate higher than the federal funds rate is commonly called a penalty rate. When the discount rate is a penalty rate, borrowed reserves and, therefore, total reserves are little affected by a change in the federal funds rate. The preceding section explained that the money supply function has the same shape as the supply of total reserves. In particular, the money supply function possesses an interest-insensitive segment corresponding to that of the supply of total reserves. Thus, with a penalty discount rate, the entire money supply function is highly insensitive to the federal funds rate, as shown by M_D^S in Figure 3. As a reference, the money supply function implied by current discount window policy, M^S , is reproduced from Figure 2.

A surcharge rate

A less extreme discount window policy is to charge frequent users of the discount window a penalty discount rate while simultaneously charging occasional borrowers a nonpenalty rate. In fact, the Federal Reserve has used such a policy on two occasions within the past three years. In March 1980, a discount rate surcharge was imposed on large banks that borrowed frequently at the window.²⁰ The surcharge, designed to "discourage frequent use of the discount window and to encourage banks with access to money markets to adjust their loans and investments more promptly to changing market conditions," was intended "to facilitate the ability of the Federal Reserve to attain longer-

run bank credit and money supply objectives."²¹ The surcharge was removed after two months, but was reimposed in November 1980 and remained in effect a year. During the time the surcharge was in effect, it ranged from 2 to 4 percent.

Borrowing behavior of large banks potentially subject to the surcharge depends on the federal funds rate relative to the sum of the basic discount rate and the surcharge. When the price of reserves borrowed at the discount window is higher than the price of reserves obtained in the federal funds market (i.e., when the basic discount rate plus the surcharge is more than the federal funds rate), large banks potentially subject to the surcharge have an incentive to avoid the discount window. When the federal funds rate is more than the basic rate plus the surcharge, large banks tend to resume discount window borrowing.

The money supply curve in a surcharge rate environment is shown as M_S^S in Figure 3. When the federal funds rate is between the discount rate and the discount plus surcharge rate, the money supply curve is steeper than it is under the current discount window policy, as demonstrated by a comparison of M_S^S with M^S in Figure 3. Over this range of interest rates, with only small banks borrowing, borrowed reserves are less sensitive to the interest rate. As a result, the supply of total reserves and, therefore, the supply of money are less interest sensitive. When the federal funds rate exceeds the discount plus surcharge rate, large banks resume borrowing and the original interest sensitivities of the supply of reserves and the supply of money are restored.²²

²⁰ Banks with deposits over \$500 million that borrowed for two consecutive weeks or for more than four weeks in a calendar quarter were required to pay the surcharge in addition to the basic discount rate. On October 1, 1981, the formula for applying the surcharge was changed from a calendar quarter to a moving 13-week period.

²¹ Federal Reserve press release, March 14, 1980.

²² For a more detailed explanation of the effect of a surcharge on the demand for borrowed reserves, see Gordon H. Sellon, Jr., and Diane Seibert, "The Discount Rate: Experience Under Reserve Targeting," *Economic Review*,

ALTERNATIVE DISCOUNT WINDOW POLICIES AND MONETARY CONTROL

A general discussion of monetary control issues is presented in this section along with an examination of the implications of alternative discount window policies for monetary control and interest rate volatility.

Monetary control

Since the money stock responds to changes in nonborrowed reserves, achieving a desired money stock would seem straightforward. The Federal Reserve would determine the level of nonborrowed reserves consistent with the desired money stock and then buy or sell government securities until that level was reached. This description of monetary control, however, overlooks several details. The Federal Reserve would have to be able to accurately predict money demand, borrowed reserves, excess reserves, and other economic variables. In prac-

Federal Reserve Bank of Kansas City, September-October 1982.

A third alternative, more general than either the penalty rate or the surcharge, is a graduated rate policy that specifies a rising cost of borrowing. Under this policy, low levels of borrowing could be allowed at a base discount rate below the federal funds rate. Successively higher borrowing levels would be allowed at successively higher rates. With this policy, the shape of the borrowings function could be tailored by adjusting the width of the borrowing steps over which the borrowing rate is constant or by adjusting the changes in the borrowing rate between adjacent levels. In this way, any degree of interest sensitivity in the money supply curve could be achieved.

Proponents maintain that the adoption of such a policy would enhance the predictability of borrowed reserves, particularly if the cost schedule were relied on to limit the borrowing of individual institutions and administrative pressure were eliminated. It seems likely, however, that far more institutions would use the discount window under such a policy. If that were the case, the cost of operating the discount window could increase considerably. For further discussion of graduated rate policies, see Perry D. Quick, "Discount Window Policies Without Administrative Pressures," Federal Reserve Board staff memo, May 22, 1980.

tice, changes in these variables prevent perfect control of the money stock. Another complication is that factors unrelated to open market operations can affect nonborrowed reserves. These factors include float and Treasury deposits at the Federal Reserve, both of which can and do change quite unpredictably.

Within the framework of Figure 2, an unexpected change in nonborrowed reserves, excess reserves, or the level of interest-insensitive borrowings causes the money supply curve to shift horizontally, i.e., either to the left or to the right. Such changes are collectively referred to as money supply disturbances. In general, a money supply disturbance affects the money stock. As will be seen below, the change in the money stock depends on the slopes of the money demand and money supply curves and typically is less than the horizontal movement in the money supply curve. That is, the effect of a money supply disturbance on the money stock is dampened without direct action by the Federal Reserve. In the absence of other considerations, this automatic control of money supply disturbances is desirable. However, open market operations, like money supply disturbances, shift the money supply curve. Thus, if money supply disturbances have little effect on the money stock, open market operations also have relatively little effect on the money stock. That is, a tradeoff exists between the Federal Reserve's discretionary control of the money stock and the automatic control of money supply disturbances.²³

The money demand curve also can shift because of unanticipated changes in economic variables. For example, shifts in money de-

²³ Discretionary control is important to the extent that open market operations entail costs. If discretionary control were low, major security dealers' inventories might be insufficient, on occasion, for the Federal Reserve to effect a desired change in the money stock.

Figure 4a

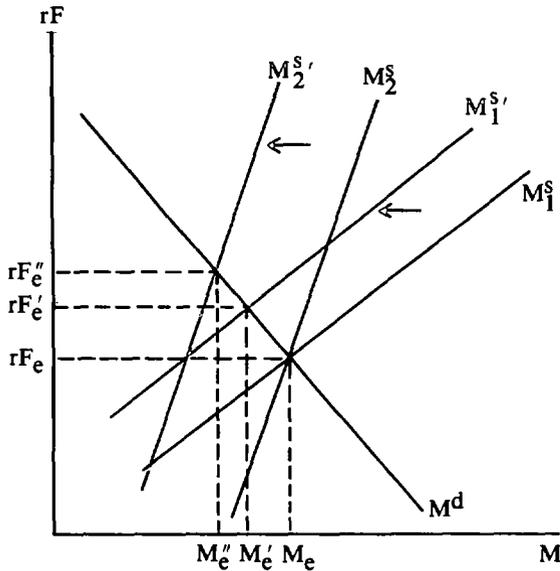
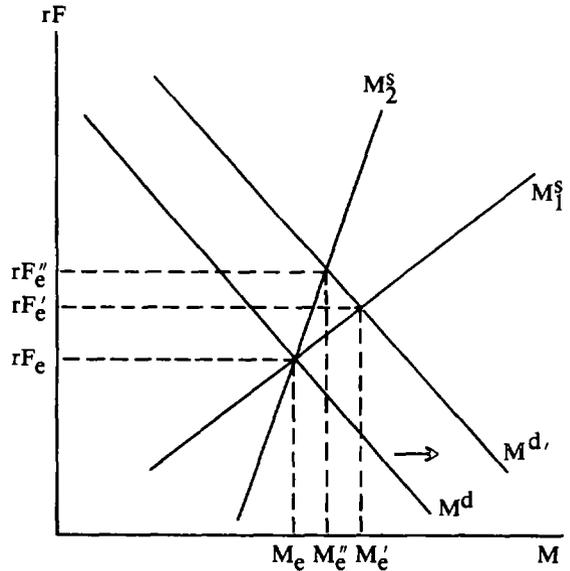


Figure 4b



mand can result from unanticipated changes in income and unanticipated changes in liquidity preference. An unanticipated changes money demand shift is called a money demand disturbance.

As with money supply disturbances, the effect of a money demand disturbance on the money stock can be dampened without direct action by the Federal Reserve. The extent of automatic control is again determined by the slopes of the money demand and money supply curves. An additional complication is that in some instances the Federal Reserve may consider the automatic control of a money demand disturbance undesirable. For example, it might want to accommodate an increase in money demand if it thought uncertainty was responsible for an increase in demand for liquidity.

Whereas the Federal Reserve may be concerned primarily with achieving its money stock targets, it also has to be aware of the implications of monetary policy for interest rate volatility. Indeed, interest rate volatility can differ

considerably under alternative discount window policies.

As was demonstrated in the previous section, discount window policy affects the slope of the money supply function. Consequently, the choice of discount window policy has implications for each of the issues considered above—automatic control of money supply disturbances, the Federal Reserve's discretionary control of the money stock, automatic control of money demand disturbances, and interest rate volatility.

The automatic control of a money supply disturbance is graphically illustrated in Figure 4a.²⁴ Two money supply curves of differing interest sensitivity are shown. The interest sensitivity of borrowings underlying M_1^s is greater

²⁴ This discussion is adapted from Gordon H. Sellon, Jr., "The Role of the Discount Rate in Monetary Policy: A Theoretical Analysis," *Economic Review*, Federal Reserve Bank of Kansas City, June 1980.

than that of M_2^S . In response to a negative money supply disturbance, due perhaps to an increase in excess reserves, the two money supply curves are shown to shift an equal distance leftward— M_1^S to $M_1^{S'}$ and M_2^S to $M_2^{S'}$. The decrease in the equilibrium money stock to M_e' under the more interest-sensitive money supply curve is smaller than the decrease to M_e'' under the less interest-sensitive money supply curve. In addition, the increase in the federal funds rate to rF_e' under the interest-sensitive money supply curve is smaller than the increase to rF_e'' under the less interest-sensitive money supply curve.

Thus, interest sensitivity in the money supply function increases automatic control of money supply disturbances and dampens interest rate volatility. On the other hand, if the shifts in the money supply curves were caused by a sale of securities by the Federal Reserve, the larger change in the money stock under the less interest-sensitive money supply curve would represent greater discretionary control. Thus, interest sensitivity in the money supply function reduces the Federal Reserve's discretionary control of the money stock.

The automatic control of a money demand disturbance, due perhaps to an unexpected increase in personal income, is depicted in Figure 4b. Unlike the result obtained for a money supply disturbance, the change in the money stock is greater when the money supply curve is more interest sensitive. That is, interest sensitivity in the money supply function reduces automatic control of money demand disturbances. However, the change in the federal funds rate is smaller under the more interest-sensitive money supply curve, as was the case for a money supply disturbance.

25 The equal leftward shifts are evidenced by the intersection of $M_1^{S'}$ and $M_2^{S'}$ at $rF = rF_e$.

In summary, the desirability of borrowing function interest sensitivity cannot be specified without reference to the source of money disturbances, the desirability of accommodating money demand disturbances, the importance of discretionary control, and the implications for interest rate volatility.

Implications for the alternative discount window policies

Of the three discount window policies considered in this article, the money supply curve associated with the current policy is the most interest sensitive. The money supply curve associated with the surcharge policy is less interest sensitive and the curve associated with the penalty rate policy is the least interest sensitive. Thus, of the three, the current policy provides the greatest automatic control of money supply disturbances, the least automatic control of money demand disturbances, and the least discretionary control. Interest rates also are least volatile under this policy.

At the other extreme, the penalty discount rate provides the least automatic control of money supply disturbances, the greatest automatic control of money demand disturbances, and the most discretionary control. Interest rate volatility is greatest with the penalty discount rate policy.²⁶ For each of these criteria, the surcharge policy scores between the current policy and the penalty rate policy.

The desirability of automatic control of money demand disturbances depends on the nature of the disturbances. If money demand disturbances are predominantly the kind the Federal Reserve needs to accommodate, a high degree of automatic control of these disturbances is not desirable.

26 For discussion of the penalty rate alternative, see J. A. Cacy, Bryon Higgins, and Gordon H. Sellon, Jr., "Should the Discount Rate be a Penalty Rate?" *Economic Review*, Federal Reserve Bank of Kansas City, January 1981.

EMPIRICAL ANALYSIS OF ALTERNATIVE DISCOUNT MECHANISMS

Empirical evidence on the implications of alternative discount window policies for monetary control was obtained from the estimation and simulation of a money market model. The effects of a money demand disturbance and a money supply shock were examined under alternative discount window policies.²⁷ This section describes the money market model and discusses the design of the simulations and the conclusions that can be drawn from them.

The model

A monthly money market model was used in assessing the effects of discount window policy on monetary control. The model consists of three behavioral equations that explain the demand for currency, the demand for transactions accounts, and the supply of borrowed reserves, plus an equation that expresses required reserves as a function of transactions accounts, and two equations that define equilibria in the reserves and money markets. Table 1 summarizes characteristics of the model.

The demand for currency and the demand for transactions account balances are functions of nominal personal income and the federal funds rate. Demands for both are positively related to income and negatively related to interest rates. An increase in personal income was found to increase the demands for the two assets in the current and the following five months. An increase in the federal funds rate was found to reduce the demands for the two assets over the same period.

The estimated supply of borrowed reserves function has the characteristics described in the preceding section. Borrowed reserves are in-

²⁷ Money supply shock is interpreted as a shift in the money supply curve caused by either a money supply disturbance or an open market operation.

terest insensitive when the discount rate is greater than the federal funds rate. They are positively related to the spread, however, when the funds rate is greater than the discount rate.

Table 1
A SIMPLE MONEY MARKET MODEL

Equations

- (1) $BR = BR(rF - rD, s, RR, D1, D2, D3)$
- (2) $CURR = CURR(Y, rF)$
- (3) $TRANS = TRANS(Y, rF, DUMNOW)$
- (4) $RR = .12 \cdot TRANS$
- (5) $NBR + BR = RR + ER$
- (6) $M1 = CURR + TRANS$

Endogenous Variables

- BR: borrowed reserves, excludes non-seasonal extended credit
- RR: required reserves
- CURR: currency
- TRANS: transactions deposits (includes demand deposits and other checkable deposits, such as NOW accounts)
- M1: currency plus transactions deposits
- rF: federal funds rate

Exogenous and Dummy Variables

- rD: Federal Reserve discount rate
- s: surcharge rate
- Y: nominal personal income
- DUMNOW: dummy variable to account for deposit shifts into NOW accounts
- ER: excess reserves
- NBR: nonborrowed reserves, includes nonseasonal extended credit
- D1, D2, D3: dummy variables based on relationship between discount rate, federal funds rate, and surcharge rate

Note: Equations 1-3 are behavioral equations and equations 4-6 are identities or definitions. All data except interest rates and dummy variables were in billions of dollars, seasonally adjusted. Reserve series were adjusted for changes in reserve requirements. In equations 2 and 3, natural logarithms of all variables except DUMNOW were used. Equations 2 and 3 were estimated using data for the period January 1977 to September 1982. Equation 1 was estimated using data for the period October 1979 to September 1982.

The interest sensitivity of borrowed reserves is reduced considerably when a surcharge is in effect and the federal funds rate is between the basic rate and the basic rate plus the surcharge. The demand for required reserves is a fraction of transactions deposits in the same month.

Simulations with the model

To examine the implications of alternative discount window policies, simulations were made with the estimated model. Of primary interest was the extent to which monetary control is determined by the interest sensitivity of the borrowings function. Three versions of the model were simulated corresponding to three levels of interest sensitivity—the zero interest sensitivity of a penalty rate policy, an intermediate sensitivity associated with a surcharge policy, and the higher sensitivity of the current policy. All three versions were simulated under three sets of assumptions regarding disturbances or shocks to the money demand and money supply functions. Each simulation covered a four-month period.

The first simulations, the results of which are reported in the top panel of Table 2, assume no unexpected changes in either money demand or money supply. These reference simulations correspond to a situation in which the Federal Reserve's initial estimates of money demand and money supply relationships are exactly correct. Thus, the desired rate of monetary growth, assumed to be 4.5 percent, is achieved precisely, regardless of the type of discount window administration. Moreover, the federal funds rate is the same for all three versions of the model, reflecting that there is a unique level of the federal funds rate consistent with the desired rate of monetary growth. If, as assumed, the Federal Reserve correctly estimates income and the other determinants of money demand, the choice of nonborrowed reserve

path and discount rate that determine the position of the money supply function must result in an interest rate consistent with the monetary growth target regardless of the type of discount window policy.

The results of the second set of simulations are reported in the middle panel of Table 2. In these simulations, a positive money demand disturbance is modeled by assuming that growth of personal income is higher than the Federal Reserve initially expected.²⁸ For the two discount window policies other than the penalty rate policy, the unexpected increase in money demand causes growth in the money stock to exceed the Federal Reserve's 4.5 percent target. Compared to the current policy, the surcharge policy provides slightly more automatic control of the money demand disturbance at the cost of a slight increase in interest rate volatility, as evidenced by the smaller increase in monetary growth and the wider range for the federal funds rate under the surcharge policy. With a penalty rate policy, automatic control of the money demand disturbance is complete and the monetary growth target of 4.5 percent is achieved. Interest rate volatility is greater, however, for the penalty rate policy than for the other two policies.

The third set of simulations assumes that demand for excess reserves is \$500 million more than the Federal Reserve expected. This negative money supply shock causes money stock growth to fall short of the 4.5 percent target regardless of discount window policy. The shortfall is most extreme with the penalty rate policy, as an annualized money growth rate of only 0.2 percent is reached. There is also extreme interest rate volatility with this policy; during the period of the money supply distur-

²⁸ The annualized growth rate of personal income in the reference simulations is 4.9 percent. For the money demand simulations, this growth rate is 6.4 percent.

Table 2
THE EFFECTS OF DISCOUNT WINDOW POLICY ON MONEY
AND THE FEDERAL FUNDS RATE

<u>Discount Window Policy</u>	<u>Annualized Growth Rate of Money</u>	<u>Average Federal Funds Rate</u>	<u>Range of Federal Funds Rate</u>
Reference Simulations (No Disturbances)			
No Surcharge	4.5 %	10.25 %	10.25-10.25 %
Surcharge	4.5	10.25	10.25-10.25
Penalty Rate	4.5	10.25	10.25-10.25
Money Demand Disturbance (Positive)			
No Surcharge	5.4	10.40	10.25-10.50
Surcharge	5.3	10.47	10.25-10.61
Penalty Rate	4.5	10.97	10.25-11.38
Money Supply Shock (Negative)			
No Surcharge	3.3	11.02	10.25-11.38
Surcharge	2.8	11.38	10.25-12.01
Penalty Rate	0.2	14.67	10.25-25.00

bance, the federal funds rate jumps to 25 percent. Automatic control of the money supply disturbance is considerably greater and interest rate volatility is markedly less with a surcharge policy than with the penalty rate policy. And, by either criterion, current policy is a slight improvement over the surcharge policy.²⁹

The results of this third set of simulations have to be interpreted differently if the money supply shock is taken to be a reduction of non-borrowed reserves brought on by a Federal Reserve sale of securities. If the monetary growth under the penalty rate policy, 0.2 percent, is taken to be the Federal Reserve's target for monetary growth, the higher growth rates under the other two policies represent less discretionary control.

²⁹ Although the results in Table 2 are based on contemporaneous reserve accounting (CRA), the same model simulations were conducted for lagged reserve accounting (LRA). The results were essentially the same. The only significant difference was with a money supply shock and a penalty discount rate. In this situation, the model resulted in extreme interest rate volatility under CRA and would not simulate under LRA. The penalty rate is not tenable under LRA.

SUMMARY

Under the reserves operating procedure adopted by the Federal Reserve in October 1979, discount window policy has become a more important factor in the Federal Reserve's efforts to control monetary aggregates. The choice of discount window policy also has more potential for affecting short-term interest rates. For these reasons, analytical and empirical investigations were made of the effects of alternative discount window policies on monetary aggregates and short-term interest rates.

Graphical analysis of a simple money market model showed the interest sensitivity of the money supply function is a critical factor in both controlling the money stock and determining short-term interest rates. The interest sensitivity of this function is directly related to the interest sensitivity of the borrowed reserves function. The latter varies widely over the discount window options considered here—current policy, a surcharge policy, and a penalty rate policy.

It was shown graphically that interest sensitivity in the borrowings function and, hence,

the money supply function, improves automatic control of money supply disturbances. On the other hand, interest sensitivity in these functions reduces the Federal Reserve's discretionary control of the money stock and the automatic control of money demand disturbances. Consequently, for the discount window policies considered in this article, the degree of automatic control of money supply disturbances should theoretically be least with a penalty rate policy, greater with a surcharge policy, and greatest with the current discount window policy. For automatic control of money demand disturbances and the potency of discretionary policy, the rankings are reversed.

The potential for short-term interest rate volatility is greatest under a penalty rate policy, less under a surcharge policy, and the least under the current policy.

The empirical investigation confirmed the theoretical analysis. The tradeoff between automatic control of money supply and money demand disturbances was evident. The relative usefulness of the discount rate options depended on the source of the money disturbance. Furthermore, the extreme volatility of short-term interest rates experienced in the penalty discount rate simulations would appear to be a strong indictment against that discount rate policy.

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